RECONCILING DIFFERENCES BETWEEN TECHNOLOGICALLY AND SOCIALLY FOCUSED THEORIES OF GROUP COMMUNICATION

by

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A thesis submitted to the faculty of
The University of Utah
in partial fulfillment of the requirements for the degree of

Master of Science

Department of Communication

The University of Utah

December 2013

The University of Utah Graduate School

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ABSTRACT

In today's highly mediated society it is very likely that communication technologies will be utilized for group interactions. Questions regarding how groups interact and how modalities of interaction factor into effectiveness, affinity, productivity and satisfaction abound. Scholarship in this area is broadly approached from technologically deterministic perspectives and social constructionist perspectives. The reality is that neither perspective is completely accurate and any argument that relies solely on technology or group dynamic as the determining variable will have failings. This thesis explores the middle ground, acknowledging that both communication mode and group construction are factors when assessing communication quality.

In order to understand the interplay between group dynamics and mediated interaction, study participants were selected from undergraduate communication courses where group assignments are a regular part of the curriculum. The study participants were allowed to work on the assigned tasks in an unstructured setting. After completion of the tasks the students were surveyed to discover how the groups organized and interacted, with a focus on determining types of interaction, satisfaction and perceived efficiency. Participant groups chose face-to-face as their preferred form of interaction (58.33%) with email the second most frequently used (34.95%). Part of the study

addresses the question of conscious selection of interaction method and the correlation with outcome satisfaction, interaction satisfaction and perceived interaction effectiveness. Groups that made active decisions on how to interact showed a significant correlation with both outcome and interaction satisfaction, while groups that interacted based simply on the preferences of the group only reported having interactive satisfaction. The results of this study lend support to both the basic tenants of media richness theory and technology deterministic theories. The primary conclusion of this thesis is that interaction based on conscious decisions by the group result in a higher level of interaction and outcome satisfaction.

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ACKNOWLEDGEMENTS

My sincerest thanks to those whose support and guidance made this possible, this document is dedicated to you.

To Professor Norm Elliot, whose fatherly council, saintly compassion and sagely knowledge enriched my life and this work in countless ways.

To Laura, Kayleigh, Ben and Liz, you were tolerant and understanding when school kept me from being an active member of the family. This would not have been possible without your patience, love and understanding.

INTRODUCTION

Technologies which facilitate communication are not neutral. The relationship between technology and interaction is situated in the dynamics of the participants and chosen method of communication (Slack & Wise, 2006). Early research into factors related to the selection and effects of communication modality has resulted in two divergent theories. Research focusing on the social influences of media choice by Short et al. (1976 as cited by Fulk, 1993) resulted in the development of social presence theory. Later studies by Daft and Lengle (1984) expanded on social presence theory, resulting in the formulation of media richness theory. The development of media richness theory effectively creates a division in the study of interaction and communication technologies, with social presence theories focusing on social influences and media richness theories exploring rational and technical effects (Robert & Dennis, 2005; Webster & Treviño, 1995).

Divergent approaches to scholarship related to this aspect of communication practice creates a conceptual framework in which the capabilities of technologies used in specific types of interactions can be explored in detail. However, in practice "the dichotomy between 'rational' and 'social' influences seems artificial and perhaps unnecessary" (Rice, Kraut, Cool, & Fish, pg. 288, 1994 as cited in Webster and Treviño,

1995). This artificial division fails to capture the subtleties of natural communication because the typical approach used by scholars is to create environments where group and social factors are eliminated in order to study the effects of specific communication modalities.

Taking time to study communication technologies in a natural setting, while complicated by the lack of control over situational variables, may reveal many of the subtleties in the interaction between social and technological factors and help reconcile what can be seen as two competing theoretical perspectives on the subject of communication technology. This thesis studies specific aspects of the influence of technology and social factors on interaction among individuals in small groups, engaged in task-oriented interactions. This study addresses questions related to which of the presented theoretical perspectives provides the clearest insight into group performance, practice and satisfaction with the interactive experience. To accomplish this, students in undergraduate communication courses requiring the completion of assignments within groups were surveyed to learn about how they chose to interact, and their reported level of satisfaction and perceived effectiveness with those interactions. The participants were surveyed to assess whether conscious choices in interactive mode can be identified and whether those decisions can be attributed to social factors, task-technology fit or a mixture of both. Quantitative analysis of the survey results are reported utilizing basic descriptive statistics, correlation and analysis of variance (ANOVA) for between group comparisons for suggestive directions toward predictive models based on the presented hypotheses.

Three aspects of task oriented group interaction are explored: mode selection, effectiveness and satisfaction. Mode selection is related to the question of how

individuals within a group choose to interact. At issue is whether members of a group choose methods of interaction based on perceived benefits and capabilities versus selection of communication mode based on preference or convenience. For the purposes of this study, effectiveness is not measured in terms of time spent, numbers of interactions or an assessment of the project outcomes but a subjective assessment by the participants with respect to whether they felt their interactions were effective. Put plainly, does the mode of interaction correlate with an overall participant rating of interactive effectiveness. Similarly, satisfaction is based on how the participant feels about the interaction process as well as the outcomes of their project.

The goal of this study is not to invalidate a particular theoretical perspective. Rather, the purpose is to identify influential factors from the presented theoretical perspectives which enhance or degrade the experience of individuals working in a small group setting. By identifying these factors it is hoped that this study may be able to provide the basis for further research in the area of mediated small group interaction and contribute to the ability of educators and project managers in expediting group process.

THEORETICAL PERSPECTIVES EXPLORED

The goal of this thesis is to analyze both technologically-focused and socially-focused communication theory in an effort to find ways to frame the discussion of group interactions where communication technologies and social setting are both part of the interactive experience. Such a synthesized perspective must acknowledge both the influence of technology upon interaction and the unique characteristics of the participants and the context of the interaction. To accomplish this, a review of transmission oriented theories and social construction theories are compared. This is done with the goal of identifying the influences of communication technologies, and corresponding theories which identify more social characteristics of group interactions.

The study of mediated communication is divided into two primary theoretical perspectives from which scholarship addresses the question of how individuals and technology interface for the completion of tasks and daily interaction. These two general classifications of theory fall within the broader discussion of communication as ritual or as transmission. The transmission model focuses on moving information from a sender to a receiver via a communication medium. The transmission metaphor is founded in locality and geography, where time and distance are obstacles to overcome and the

medium is discussed using terms like engagement and information carrying capacity (McLuhan, 1964).

Accordingly, much of the scholarship in the field of mediated communication focuses on theory where the technologies involved in the transmission of the message and the capacity of that technology to convey information are the focus. Communication theories based on active media-use choices are generally constructed along a continuum from low to high social presence, where social presence is assessed by determining how well the mode of communication matches the requirements for interpersonal interaction and facilitates awareness of the other participants in the interaction. These theories generally evaluate efficiency or satisfaction as a measure of the relationship between the task and the mode of interaction. Research focused on the use of low-cue settings like email or text messaging indicate that the use of these mediating technologies are less efficient because of the extra time required to type the messages and time lost due to delays in interaction. All this is based on the premise that there is a rational, choice making process where efficiency is a motivating factor in the decision process (Fulk, Schmit & Steinfield, 1990).

Other researchers argue that lean media can be more efficient for task-related communication because the lack of feedback cues allow the participants to stay focused on the task, thus avoiding the exchange of nonessential information and allowing for more deliberate crafting of messages (Dennis & Valacich, 1999; Robert & Dennis, 2005; Suh, 1999; Walther, 1996). Results from research based on social information processing theory (Walther, 1992) and media synchronicity theory (Dennis & Valacich, 1999) indicate that specific types of mediated interaction may surpass the experience of communicating face-to-face. These researchers argue that mediated group interaction

can be superior in terms of decision quality, task completion time and participant satisfaction.

Generally speaking, these theoretical explorations are framed around the matching of communication modality with a given task (task-fit theories) or social construction theories. The latter perspective recognizes the dynamics of group structure and organization as the dominant influence relating to interaction effectiveness and satisfaction, placing the mode of interaction as a secondary factor. The following section reviews theories related to both of these outlooks in order to provide a foundation for exploring the relationship between these two perspectives.

Task-Fit Communication Theories

Technologically focused communication studies focus on the transmission medium to determine how the message is influenced by the mediating technology. These communication technologies are seen as the vehicles for conveying ideas and information between the interacting participants. Different technologies like email, video conferencing and the telephone are expected to influence messages, and hence, influence interaction differently. The development of several theories (Daft & Lengle, 1984; Dennis & Kinney, 1998; Hollingshead et al., 1993; McGrath, 1991; Straub & Karnahanna, 1998; Suh, 1999) have resulted from exploring the relative benefits and failings of communication technologies, specifically engaging questions of what kind of information is best conveyed by differing media types and how the medium influences the message.

In contrast to the focus on questions of what and how, social influence theories focus on the why of media choice including the ways social interaction frames perspectives on the technology. From this approach, influences like attitudes and

behaviors of coworkers, supervisors and other social interactions provide a context for selecting modes of communication. Patterns of interaction established by participants within an organization place expectations on which modes of communication are valued or expected for particular purposes. Establishment of these norms within a given setting provides cues for what are considered appropriate, effective, acceptable, or normal as methods of interaction (Webster & Treviño, 1995). When social influences bias the process of medium selection, technical capabilities may not enter into the decision. To further complicate matters, the capabilities of different communication modalities can place additional cognitive loads on participants, which may in turn cause interference with the conveyance of information. The mode may convey too much information and provide distractions, or the mode may communicate a lack of importance and encourage participants to disregard the message (Lionel & Dennis, 2005).

These two theoretical perspectives are not mutually exclusive. Media richness theory (Daft & Lengle, 1984) and subsequent related theories (Fulk, 1993; McGrath, 1991; Walther, 1992) recognize that there are social influences on the selection of medium. Conversely, social influence theories recognize the technical capacity of the various mediums as a moderating influence in the selection process. Primary theories from both perspectives are presented in the following sections to provide a research framework for this thesis.

Media Richness Theory

Media richness theory (Daft & Lengle, 1984) argues that rich media are more effective at conveying information and that these modes of communication are best suited to interactions with high levels of ambiguity. Rich media is described as being high-cue

or having many of the interactive characteristics of face-to-face communication, including the ability to convey emotion and provide for a high degree of interactivity (Fulk, 1993). Media richness theory posits that the selection of a communication medium should be constructed from the intersection of the capabilities of a communication technology and the content transmitted message (Webster & Treviño, 1995). Complex messages, or ones which can be characterized as having rich information requirements to convey emotional, attitudinal, normative, and other meanings beyond the basic text of the message, require a rich or high-cue communication medium. By contrast, simple messages, which may primarily consist of sharing simple facts, can effectively use low-cue environments (Hollingshead, McGrath & O'Connor, 1993).

Research conducted by Baltes et al. (2002), supporting the general premise of media richness theory, concluded that "computer-mediated decision-making groups are rarely if ever more effective than face-to-face (face-to-face) groups, that computer mediated communication (CMC) group members are rarely if ever more satisfied than members of face-to-face groups, and that CMC groups rarely if ever take less time than face-to-face groups" (pg.175). Other research, which lends support for media richness theory, indicates that non-face-to-face, voice interactions (e.g., phone) require the least amount of time for task completion, followed by face-to-face and text-based CMC requiring the most time (Suh, 1999).

Contrasting research by Robert and Dennis (2005) identifies paradoxical problems with media richness theory and the fundamental notion that high-cue settings are best for complex, equivocal concepts. Expanding on Thorngate's "Economy of Attention" (1990), Robert and Dennis (2005) argue that communication settings with

high social presence demand attention and signify importance while communicating with low presence modalities can be easily ignored because the receiver is not obligated to give the message attention and may attribute reduced importance to the message. This leads them to argue that communication settings with high social presence result in an increased cognitive load. In turn this requires individuals to narrow their attention, making the conveyance of complex ideas problematic because lapses in concentration and distractions may cause important information to be lost. In contrast, communication modes low in social presence give the participants the ability to reprocess information, thus allowing for more time to comprehend the message.

Media richness theory scholarship has a divided history of supported and challenged research. The paradox described by Robert and Dennis (2005) highlights these complexities. Expansions and challenges to this fundamental theory are offered in the following two theories.

Time Interaction and Performance Theory

McGrath's time, interaction and performance (TIP) theory (Hollingshead & McGrath, 1993; McGrath, 1991) posits that groups may participate in any of four different varieties of task-related communication: inception, technical problem solving, conflict resolution, and execution. McGrath describes a task as "a sequence of activities instrumental to the completion of a particular project"(pg. 151, 1991), where a project may have multiple tasks and a task may be comprised of many steps. Within task communication, inception refers to defining project goals while problem solving refers to communication related to planning and logistics. Depending upon the nature of the task, varying combinations of interaction types are expected. At the very least, individuals

engaging in task-related communication experience inception and execution and also have a high likelihood of experiencing problem solving and conflict resolution as part of the process.

Hollingshead, McGrath and O'Connor (1993) describe four general classifications of tasks (see Table: 1) and prescribe the ideal modes of communication based on the intersection of media richness and task type. The prescribed communication mode is based on the perceived benefit or liability related to having multiple channels of communication available while working on the task. Hollingshead and McGrath (1993) have expanded CMC research by acknowledging that more than the communication medium is involved in determining the performance and satisfaction for individuals engaged in the completion of a task. “It appears that the characteristics of the group, the communication medium, and the task type may all moderate the effects of electronic technologies on group process, performance, and user satisfaction“ (Hollingshead, 1993, pg. 308).

Media Synchronicity Theory

Expanding on McGrath’s TIP theory, Dennis and Valacich (1999) developed media synchronicity theory (MST), which posits that the “richest” medium is the one that best provides the set of capabilities needed by the situation. This is not unlike the general premise of media richness theory; however, media synchronicity theory emphasizes the correlation of media type, message, and type of task, thereby contesting the status of face-to-face communication as the richest medium. Media synchronicity theory focuses on finding the correct combination of communication mode and task. Task, participants and social context all inform the communication technology selection process. The

theoretical outcome is the implementation of a communication context in which the unique requirements of the task, the characteristics of the group, and the selection of the optimal communication technology result in an effective interaction. MST recognizes that not all communicative exchanges require the same level of interactivity and that not all tasks benefit from highly rich communication environments (Dennis & Valacich, 1999). Additionally the tasks themselves are not uniform in their communication needs. Some exchanges may require greater capacity for convergence while other exchanges benefit from increased ability to convey information. Switching modes based on the communication requirements of the moment is at the core of media synchronicity theory.

To understand the distinct requirements of different interactions, Dennis et al. (1998), identify the following characteristics of communication technologies: feedback, concurrency, persistence and rehearsability. Feedback is related to the degree of interactivity provided by a given technology. If the technology provides near simultaneous interactive capacity between the sender and receiver, the technology is considered to have a high degree of feedback. Concurrency deals with the number of simultaneous communication interactions that a technology can manage. For example, the traditional phone conversation can support one communication interaction at a time with high level of feedback. In contrast, email as a communication technology can have multiple communication exchanges taking place simultaneously, however, the degree of feedback is limited by the speed at which the recipient responds to the email message. Face-to-face meetings can have a high level of concurrency with all of the participants in a meeting interacting nearly simultaneously and provide a high degree of feedback, hence the high-cue designation. Persistence and rehearsability are characteristics of low cue interactions where the mode of communication allows the message to persist in time and

allows the participants to take time to compose messages, allowing for the most effective sharing of information.

Task-oriented communication as categorized by Dennis and Valacich has two distinct characteristics: conveyance and convergence. Conveyance is a type of communication focusing on information exchange[1], characterized as having a low synchronicity requirement. This is typical of preliminary interaction in a task related setting, characterized by brainstorming, information gathering and exchange, and task delegation. The low-cue nature of some forms of computer mediated communication like email may be beneficial for the conveyance stage of communication associated with inception and logistical discussion.

Communication focusing on developing shared meaning is defined as convergence. The need for immediacy of feedback is key to the process of convergence (Dennis & Valacich, 1998). The participants work toward agreeing on the meaning of information and agree that they share that meaning. "This means that participants must understand each other's views. In general, high synchronicity and feedback is preferred for convergence" (Dennis & Valacich, 1998, pg. 5).

Beyond the discussion of how different modes of communication allow for information exchange is the question of how individuals construct understanding through the act of communicating. Using the transmission model, participants engage in communication focusing upon interaction within a social or informational setting founded upon the transmitted messages. The problem with this perspective is the assumption that all interaction is occurring within a vacuum without taking into consideration the cultural

[1]Hollingshead identifies this type of interaction as generative and prescribes low-cue methods of communicating.

and organizational setting or the integration of members within a community (Holmes, 2005).

Social Construction Perspectives

The social construction perspective acknowledges that the participants and the technology are situated within a social context, where group history, established communication practices, and familiarity with communication technologies are moderating influences on the capabilities of the differing transmission modes. Perceptions regarding the efficacy of modes of communication are subjective and at least partially constructed by the members of the social framework. By viewing interaction from the social perspective versus the technological perspective, different insights into how people communicate and the effectiveness of the different communication modalities are gained. Social influence may come in the form of observed practices or direct influences by the members of the group. However, the motivations for interacting in a particular fashion need not be motivated by efficiency (Fulk, Schmit & Steinfield, 1990). By applying this perspective to the discussion of mediated communication, the center of the discussion shifts from the technology to the participants.

Social Influence

When individuals collaborate on a project they form a group. Groups can be identified with the following characteristics (McGrath, 1991):

- The individuals comprising the group.
- The social and organizational structures in which they are situated.

- The collection of shared purposes, which translate into tasks, projects, and strategies.
- Experience in the form of resources, skills, knowledge and abilities.
- A series of activities and the related outcomes of those activities.

These characteristics are derived from community theory (Tönnies, 1955) where a group is defined by the needs of individuals as they join together in performing the task. However, there is more to the interaction than completion of the task alone. Group composition, the nature of the task, and available technologies taken together create situations where an ideal combination of task, personnel, and technology will dictate the most effective outcome. Groups establish norms based upon the resources available to them. The variety of communication technologies at their disposal is just one of those resources.

Part of this normative behavior is the social construction of the technology. Attitudes of the participants influence their choice of technology use. These attitudes and perceptions can establish perceptions of effectiveness. These attitudes may be formed prior to the interaction of the participants or may be formed during the course of the interaction. Regardless of when the attitudes are formed, the attitudes are difficult if not impossible to separate from the technology itself (Fulk, 1993; Treviño, L. K., Webster, J., & Stein, E. W., 2000). According to Fulk, groups select both technology and social structures in order to establish a setting for social interaction. The setting for interaction is established based on previous experience with the members of the group, biases toward methods of interaction and previous experience with the type of interaction at hand. social information processing is one theory that places the participants at the center of the interaction versus the mode of interaction.

Social Information Processing

Social information processing (SIP) theory argues, "virtual teams have the potential to offer greater flexibility, responsiveness, and diversity of perspectives than traditional groups" (Walther, 2005, pg 829). SIP theory recognizes the unique ways in which different communication media allow interaction to take place (Walther, 1992, 1995, 1996; Walther & Bunz, 2005). Walther's research considers how individuals' perceptions of others are influenced by the communication medium. He specifically focuses on how the impersonal characteristics of low cue environments can be more productive by allowing the participants to stay focused on the task while eliminating distractions that would be prevalent in face-to-face or other high-cue settings (1996). Another aspect of this theory, known as hyper-personal communication, describes how participants using lean media have a tendency to describe their interactions and the individuals with whom they are interacting in favorable terms. One unique kind of interaction, which is solely experienced via text, is what Walther (1996) describes as hyper-personal interaction. These interactions are characterized by heightened state of emotional engagement. This type of interaction is typically restricted to social settings but may be experienced in the workplace as well. Hyper-personal interaction requires extended time with the following social constructions:

- Reduced cues in the communication environment. In order for hyper-personal interaction to take place a lean communication medium must be used.
- Idealized perception on the part of the receiver. Lacking other indicators, the receiver engages in a process of over-attribution, creating a condition

whereby the other participant is viewed in the most favorable light possible.

- Optimized self-presentation by the sender. The asynchronous nature of text-only interaction allows the participants to craft messages that convey positive characteristics while concealing negative attributes.
- Intensified feedback. This addresses the previous two items, where the combination of optimized presentation on the part of the sender coupled with idealized reception creates situations in which the interaction is viewed as hyper-positive, or possibly in a hyper-negative light (Walther, 1996).

Communication technologies, like tasks, are equivocal and may be constructed in multiple and perhaps conflicting ways depending upon the norms of the group. Some of the results presented by Walther and Bunz (2005) support this concept. Media richness theory posits that lean communication environments will typically be impersonal. However, Walther's research indicates that when individuals spend time interacting even without the support of face-to-face or other rich communication environments, the interactions will be as meaningful and perceived as rich as traditional interpersonal interactions.

Relating to the establishment of group norms, Fulk (1993) identifies task routineness as a qualifier for medium choice. When a task is identified as routine, by the group members, a lean communication mode may be selected because it requires less interaction by the participants. Routineness also implies that there is little ambiguity with respect to task at hand. The task may be complex but if it is engaged in frequently there is little need for the added detail that rich media can convey. Conversely, a non-routine task

may call for the use of a rich communication mode in order to eliminate the possibility of ineffective communication, which may in turn lead to greater confusion or conflict. As participants gain familiarity with each other and the nature of the tasks in which they engage, they are likely to establish routine communication practices for the task and group. These communication practices may be based upon communication preferences of the group or proficiencies gained by utilizing the technologies available to the group. This reverses the task and medium fit as proposed by Media Synchronicity Theory.

Media Richness or Social Influence?

Based on the findings of research used to support these social theories, the validity of media richness theory is contested but not invalidated. These studies suggest that communication effectiveness is not directly tied to the richness of the communication environment. Rather, they posit that the type of information conveyed or the purpose for the communication will dictate the most appropriate media choice (Dennis & Kinney, 1998). Making observations using ritual perspectives of communication instead of the transmission model changes the construction of computer mediated communication, placing greater importance on the participants and the communication setting as opposed to the technology.

The ritual view is based on the understanding that communication is about sharing information, participating in dialogue, and expressing association and fellowship. In this sense it is focused upon the oral tradition of communication where the emphasis is placed upon supporting and maintaining notions of community and interaction versus the simple conveyance of information. Carey (1998) delineates this distinction between the ritual and transmission views of communication: “communication under a transmission view is

the extension of messages across geography for the purposes of control, the [...] case under ritual view is the sacred ceremony that draws persons together in a fellowship and commonality" (Carey, 1998, pg. 18). This view does not exclude the transmission of information. It merely argues that one cannot understand these processes except when they are framed within a social setting, which does not privilege the communication technology.

When discussing mediated interaction, the role of communication technologies must be placed in perspective in order to understand the associations being constructed by the participants. If communication technologies are seen strictly as tools for conveying information, as is implied by transmission models, our assessment of the utility of these technologies is detached. If, however, communication technologies are also viewed through the lens of ritual communication, our understanding expands to include the role and influence these technologies play upon how the groups change (Holmes, 2005). "Ritual views of communication contend that individuals exchange understandings not out self-interest nor for the accumulation of information but from a need for communion, commonality and fraternity"(Holmes, 2005, pg. 123). Ritual communication theory suggests that communication mediums should not be viewed primarily as a means of interaction but for purposes of integration.

Each of the theories reviewed provide different perspectives on how media use can impact the decision making process. Media richness theory argues that greater media richness leads to greater satisfaction in the decision making processes. In essence, rich media lends itself to a greater degree of both satisfaction with the outcome and with interaction between the participants (Dennis & Kinney, 1998; Suh, 1999). Conversely social information processing (SIP) theory argues that for short-term generative tasks,

low-cue modes of communication are more efficient. This theory also posits that given enough time for development, low-cue environments can achieve higher levels of affinity and satisfaction than face-to-face (Walther, 1996). Media synchronicity theory and time interaction and performance theory posit that depending upon the nature of the task, different combinations of communication modes will be most effective. In work done by Hollingshead et al (1993) it was determined that there is a correlation in effectiveness between the task type and selection of media (see Table 1).

Table 1: Task Type -- Communication Mode

Task Type	Communication Mode
Generative Tasks: Planning and creativity	CMC: Lean or low-cue, text (i.e., Email)
Choice Tasks: Problem solving both equivocal and unequivocal	Audio/Video systems: Phone, video conferencing with email as a secondary choice.
Negotiable Tasks: Conflict resolution (differing viewpoints or conflicts of interest)	Audio/Video systems: Phone, video conferencing with face-to-face as a secondary choice
Execution Tasks: Performance, competition or contest.	face-to-face

Note. Adapted from Hollingshead et al., 1993

RESEARCH DESIGN

Previous research offers us both a useful and problematic basis for reconciling the influences of technology and social factors in understanding the conduct and development of communication in groups formed with the purpose of accomplishing a task. On the one hand, it seems clear that different technological modes of interaction have inherent capabilities, enhancing or interfering with effective interaction. There is a clear basis for investigating the relationships between different modalities and the interaction experiences associated with them more directly. On the other hand, it seems clear that social factors (ranging from individual preference and background to cultural/organizational practice and norms) are related not only to the interaction experiences of a group, but also to their choices of modes for interaction itself.

This body of research, while evocative and informative, is also constrained by its history of seemingly working to find simple answers to the question of what influences groups in task related communication. These lines of research explore ways technologies shape communication, often with prescriptive conclusions of how best to construct an interaction. Alternatively, the literature presents constructions of how interaction is experienced in mediated settings. This motivates us to expect a more complex and subtle interplay between modes of communication used and evolving characteristics of the

group. The current study is an initial attempt to incorporate both rationales for study (technological and social influences on task group interaction) by examining communication technology uses by naturally-occurring small task groups in terms of the satisfaction they experience. The goal is to look for the naturally occurring interplay between the technological and social and try to determine how the presented theories are actualized in a traditional classroom setting.

This study focuses on limited history groups engaged in short-term projects. It is designed to observe which communication modes are used by the participants to accomplish their assigned tasks. Analysis shows how the experiences of the students compare with the contrasting theoretical perspectives presented in the introduction. The following research questions address two different facets of interaction, satisfaction and mode selection.

Research Question 1: To what extent does media choice influence satisfaction for students collaborating on specific tasks? (hypotheses 1, 2 and 3)

Research Question 2: Which factor most influences communication mode choice: task-media fit or social influences? (hypothesis 4a/b and 5a/b)

The study investigates the satisfaction participants report based on the quality of interaction with their project partners. Social information processing theory suggests that for short-term projects, lean media environments lead to more task-oriented communication coupled with an implied lack of interpersonal warmth or closeness. Conversely, media richness theory argues that high-cue communication leads to greater interaction satisfaction. The limited group history and short-term nature of the tasks create a situation where the impersonal, task oriented communication observed by Walther (1996) would seem appropriate. However, because both conveyance of

information and convergence of ideas is expected, some form of synchronized, high-cue communication is needed to facilitate completion of the tasks. The media-task fit paradox presented by Robert and Dennis (2005) suggests that finding the correct combination of message and mode can be challenging with poor choices leading to ineffective communication.

The second area of study addresses the question of which theoretical perspective plays the largest role in determining communication mode selection. For this study, geographic limitations are not forced on the participants[2], so any combination of communication modes is hypothetically available. By leaving the selection open to the participants it is possible to see if communication mode is based on happenstance, group preference or strategic choice.

The following hypotheses are explored:

Hypothesis 1: There will be a positive correlation between the use of rich communication modes and the level of interaction satisfaction.

Hypothesis 2: There will be a correlation between the use of diverse communication modes and the level of outcome satisfaction.

Hypothesis 3: There will be a correlation between the use of diverse communication modes and interaction effectiveness.

Hypothesis 4a: Where active decisions about communication modes are made, there will be a higher level of interaction satisfaction.

Hypothesis 4b: Where active decisions about communication modes are made, there will be a higher level of outcome satisfaction.

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[2] One team did experience logistical problems which interfered with their ability to interact face-to-face. This was a result of the dynamics of the group and is representative of real world interaction and not a study design. The interaction modes the group used reflect their solution to the challenges they faced.

Hypothesis 5a: There will be decreased diversity of communication modalities used where interaction mode is based on group preference.

Hypothesis 5b: There will be increased diversity of communication modalities used where active decisions about communication modes are made.

Absent from this list of hypotheses are any questions related to the quality of the solutions achieved by the participants. The goals of this study are to reconcile the two contrasting theoretical perspectives previously presented and assess how the interaction of social dynamics and communication technologies influence interaction and satisfaction related to task outcomes and social interaction. Assessment of task completion quality could be undertaken as a follow up to this study.

METHOD

Participants

Seventy-eight students from undergraduate communication courses where group assignments are a regular part of the course curriculum were invited to report on the types of interactions experienced while working on course projects. Participants were selected from basic web design courses and small group communication courses at the University of Utah. The tasks were based on the subject material of the course. The course assignments were open in structure and can be categorized as a decision-making/performance task (Table 1; Hollingshead et al., 1993) with no precise solution. Both classroom settings provided opportunity for face-to-face interactions. As such, regardless of the task type or subject material of the course, some level of face-to-face or nonmediated interaction is expected. Additionally the assignments for both courses call for coordinating information for in-class presentations. Enacting conveyance of information and convergence of ideas was required of the students working on these class assignments. While the subject material is different the tasks are ultimately very similar. The expectation is that the students worked through McGrath's (Hollingshead & McGrath, 1993; McGrath, 1991) progression of task related modes of communication and took advantage of a diverse set of communication methods. During the course of this study

some students completed the survey multiple times based on different tasks assigned in their class. In total, the 78 students provided 105 responses to the survey used in this study.

Materials

A web-based survey (see Appendix A) was administered to each of the project participants to measure satisfaction and mode selection. The survey is designed to gather information regarding the total amount of time spent interacting face-to-face and via other communication technologies. Participants were asked to identify what percentage of their time is spent using text-based, voice only and face-to-face communication. To determine why particular communication modes were selected participants were asked whether availability and accessibility of the group members was a deciding factor and what other factors, if any, motivated their choices. The survey also contains questions designed to ascertain participant satisfaction in both the outcome of the project and their interactions with their project partner. For example:

- I am very pleased with the outcome of the presentation
- I am pleased with the performance of my colleagues

A four point Likert scale (1= strongly disagree, 2= disagree, 3 = agree, 4 = strongly agree) is used to determine how well the respondents agree with each question.

The survey was reviewed by a sample of undergraduate, graduate and university faculty and staff to verify question clarity prior to its administration. This study has been approved by the University's institutional review board (Study # IRB_00027162).

Procedure

At the beginning of the course, students were given time to meet and exchange contact information in preparation for their work. Each of the courses selected for this study has two or three projects which student groups are required to complete. The students were given freedom to use any media types they desire for making preparations for subsequent assigned presentations. At the conclusion of each of the assigned tasks the students were given the URL of the survey and asked to complete it.

Analysis

Initial analysis of the data provided the framework for identifying which individuals are associated with groups for comparative analysis. The participants are grouped into three categories of media use (low, medium and high) based on the gathered data. Following the initial analysis of the participant data, for the purpose of dividing the participants into groups related to the specific hypotheses, between group analysis using the ANOVA procedure was performed related to the group types and hypotheses.

Type of Media Use

The subjects in the study were classified as high, moderate or low media users based on the amount of time they reported interacting face-to-face versus via other modes of interaction. Low-media users are individuals that report using face-to-face for the majority of the interaction time. Moderate-media users are individuals that report using a balanced mix of face-to-face and communication technologies. High-media users are individuals that report using communication technologies for the majority of the interaction time. The distribution of the participants into the three categories was

accomplished by performing a simple frequency analysis. Survey questions related to the percentage of time that participants used face-to-face, email/text message, phone, instant messaging or voice message were used to determine media use categories.

Mode Selection Process

Interaction mode selection based on group preference was indicated by scores on survey questions 9, 10 and 19. Question 19 addresses the question of whether the group made a collective decision about how to interact. A high score supposes passive mode selection. Active media-use selection was defined by individuals or groups making conscious decisions about their modes of communication used to accomplish the task. Questions 12, 13 and 18 indicate an active decision making process. A high active media selection index supposes a greater reliance upon communication technologies. Survey questions regarding how communication mode was selected were used to determine mode selection.

Effectiveness

Effectiveness is based on feedback from the participants on how well the mode of communication matched the task and whether the communication mode facilitated completion of the task or interfered. Groups can be separated into high and low effectiveness segments. It is important to note that total time spent is a difficult measure of effectiveness because time spent is a function of both effective communication practices and effort applied to the task. As such a team may have invested a great deal of time in completing a task and used effective communication practices resulting in a high quality outcome or the same amount of time may have been spent with poor

communication practices resulting in a low quality outcome. As the quality of the task outcome is not a focus of this study, effectiveness is measured based on participant perception and will be contrasted against selection process or satisfaction measures. Survey questions regarding perceived communication effectiveness were used to determine this measure.

Satisfaction

For the purposes of this study, satisfaction is the measure of personal comfort or pleasure experienced during the communication processes. Experiences where the modality of interaction introduced difficulties supposes a low degree of satisfaction while high satisfaction is theorized as being an outcome based on interactions which are facilitated by the chosen modality.

There are two types of satisfaction measured in the study, satisfaction with the outcome of the assigned task and interactive satisfaction between the participants. It is supposed that interaction satisfaction will be related to higher levels of face-to-face communication. High satisfaction with the outcome of the task will be related to effective communication practices. Survey questions addressing individual satisfaction with the outcomes of the task as well as the interactions with team members were used to determine satisfaction.

DATA ANALYSIS AND RESULTS

Current Study

The purpose of this study is to investigate the interactions between students engaged in the completion of a short-term task while participating in a typical undergraduate university course. The fundamental issues explored are group interaction and how communication technologies and group dynamics relate. Data for this study were gathered over the course of 18 months from six separate undergraduate communication course for a total sample of 105 students. The average age of the participants is 25.1 years with 50% of the participants being male. The subjects used in this study were participants in classes where the completion of a group project was a core component of the class. The participants were asked to log the amount of time they spent interacting with their partners during the completion of the task. Due to the differing classroom settings, project specifics and degree of student involvement, it would not be meaningful to perform analysis with time spent as a primary variable. The students did report interacting for an average of 212.7 minutes to complete their tasks.

The primary focus of this study is to gain understanding regarding how different groups choose to interact when completing a task. With the exception of hypotheses 4a/b, all of the questions in this study address communication mode. The following sections

identify the primary variables assessed in this study, the primary analysis processes used to determine if the factors in question support or fail to support the proposed hypotheses, and supplemental analysis conducted to further explore and clarify the findings from the primary analysis.

Primary Variables for Statistical Analysis

Seven different measures are used to address the presented hypotheses: media use, interaction satisfaction, outcome satisfaction, active media selection, strategic media selection, interaction effectiveness.

Media Use

For the purposes of this study face-to-face communication is considered to be a rich communication mode. Use of mediating communication technologies for interaction constitutes using media. Depending upon the degree of media use, participants are classified as low, moderate and high media users.

Communication mode use is calculated by running a frequency test on the percentage of time spent using face-to-face communication. Three comparable sized intervals were created with classification based on level of media use: low-media users, moderate- (or mixed) media users and high-media users. The survey instrument asks each subject to identify the distribution of communication time between five different communication modalities. Face-to-face interaction time was selected as the factor by which the participants are filtered because all of the classes from which the participants were drawn have regular in-person meetings. Face-to-face interactions would be an expected form of interaction for the subjects. Furthermore, the general premise of media

richness theory places this form of interaction as the standard by which mediated interactions are compared.

Participants are divided into the three different categories by performing a frequency analysis on the reported use of face-to-face interaction time. High-media users are categorized as participants reporting face-to-face interactions between 0% and 41.66% (*n*=35) of the reported interaction time. Moderate-media users are categorized as participants using face-to-face interaction between 41.67% and 79.9% (*n*=30) of the reported interaction time. Low-media users reported interacting face-to-face 80% or more (*n*=40) of the time.

Data gathered from this study have been broken up into three mediated communication categories (see Table 2). The mean face-to-face interaction score was 58.33% (*n*=105, *sd*=32.07). Seven groups indicated using face-to-face interaction exclusively to complete their task. Email was the second most frequently used method of interaction with an average of 34.95% (*sd*=29.64). One group completed their task exclusively via email and logged no face-to-face interaction time. This was due to circumstances that physically separated the project's partners during the scheduled task completion time. Nine teams utilized no communication technologies in the completion of the task. Phone interaction ranked third with an average of 5.29% (*sd*=9.7) of the students interaction time spent using that mode. Instant message and voice message represented small percentages of interaction time.

Interaction Satisfaction

Interaction satisfaction addresses questions of the nature and quality of the engagement experienced by the group participants. This variable quantifies what it was

like to interact with the members of the group and how each participant felt about the quality of the interactions with members of their team. The variable does not assess the project outcome or the effectiveness of the interactions.

The interaction satisfaction score is generated by taking the mean value of six questions addressing quality of interaction in the survey (see Appendix A). Each question on the survey employed a four point Likert scale with options ranging from 1 to 4, with 1 being very dissatisfied and 4 being very satisfied. The mean interaction satisfaction score is 2.8 (n=112, sd=0.4), indicating the overall interactive satisfaction of the participants is slightly above the midpoint. The mean interaction satisfaction score will be used as one of the measures to test hypotheses 1 and 3.

Outcome Satisfaction

Outcome satisfaction is the measure of how pleased the participant is with how the group completed the assigned task. This variable is used as one of the measures to test hypotheses 2 and 3. These questions do not address interaction quality or effectiveness. This score was generated by determining the mean score of questions 14 and 24. These questions are related to how positive the participant feels about the outcome of the task and how engaged the participant was in completion of the assignment. Each question on the survey employed a four point Likert scale with options ranging from 1 to 4, with 1 reflecting a poor evaluation on the completed task and 4 a positive evaluation. The mean outcome satisfaction score is 3.41 (n=112, sd=0.4) indicating that the students rated their performances and engagement positively.

Interaction Effectiveness

Interaction effectiveness is a subjective evaluation by the participant. Effectiveness in this setting assesses whether the communication methods employed interfered with or facilitated completion of the task. Six questions (10, 16, 17, 22, 25, 26) from the survey relate to how effective the participant felt their interactions were. As with the other evaluative questions in the survey, a four point Likert scale was employed with options ranging from 1 to 4. The mean interaction effectiveness score is 2.87 (n=89, sd=0.3).

The survey tool did ask the participants to report interaction time. However, the nature of the tasks varied from course to course such that using time spent as a measure of effectiveness was impossible. The questions in the survey address aspects of interaction that are common to any task-related small-group interaction. These responses should provide an accurate measure the effectiveness of their communication processes.

Active Media-Use Decisions

Study participants were asked three questions (12, 13 and 18) designed to assess how active their decision making process was with respect to the modes of communication selected for completion of the task. The focus of these questions is to determine whether the participants consciously made decisions on how to interact based on project or participant needs. The expectation is that the outcomes of these decisions results in actively selecting the communication mode that most effectively meets the needs of the group's situation.

Each of the questions used a four point Likert scale to measure the degree of active decision making applied to their use of communication technology with 1

representing a low level of active decision making and 4 a high level of active decision making. An active media-use decision score was generated by finding the mean score of the three relevant questions. The mean active media use score is 3.16 (n=89, sd=0.44), indicating a relatively high degree of active decision making. This measure is used in the analysis of hypotheses 3, 4a and 4b.

Group Communication Preference

Questions 9, 11 and 19 from the survey asked about the role personal preference had in the selection of communication mode. The purpose for these questions is to assess the degree to which communication habit and interaction preference dictates how the members of the group interact. As with the other questions in the survey, participants were asked to respond to the question using a four point Likert scale to express their level of agreement with each of the statements. The mean value of the three questions will be used as the group communication preference score. The mean group communication preference score is 3.04 (n=89, sd=0.56). This is the primary variable for hypothesis 5.

The analysis for hypothesis 5 will use the ANOVA test to make comparisons between face-to-face interaction levels of groups that reported a mode preference as a primary factor in deciding how to interact. To identify this group a frequency analysis (see Table 3) was performed to divide the participants into three groups based on the degree of preference identified. Based on the participant's reported usage of face-to-face interaction time the following three media use groups were created.

Summary of Primary Variables

Each hypothesis will be tested using the values assigned to each of the primary variables. The following table (see Table 4) displays these variables for this study together with a synopsis of questions used to gather information from the participants. The media-use variable describes the approximate percentage of time spent using a particular communication mode. The values assigned to the remaining variables are generated by aggregating the scores from the listed survey questions.

Tests of Hypotheses

Hypothesis 1

There will be a positive correlation between the use of rich communication modes and the level of interaction satisfaction.

This hypothesis addresses the question of whether the use of communication technologies for the completion of the task influences the level of interaction satisfaction between the participants. The contention is that a greater use of rich communication modes like face-to-face will yield a higher degree of interactive satisfaction. The results of a Pearson correlation analysis of the satisfaction score and level of media use score results (see Table 5) have a correlation that supports the proposed hypothesis. (p=.007, r=0.260 N=105).

Hypothesis 2

There will be a correlation between the use of diverse communication modes and the level of outcome satisfaction.

For this analysis the participants are separated into low, moderate and high media use categories. This was done to isolate the moderate or diverse media use group in contrast to those that used high or low levels of mediated communication. The premise of this hypothesis is that participants that utilize a blend of both rich and lean media will experience a higher level of satisfaction with the final outcome of their task than those that used a preponderance of face-to-face or mediated interaction. The expectation is that groups using diverse modes of interaction will overcome the theorized limitations of very lean mediated environments as well as the social inefficiencies of face-to-face settings, that might interfere with finding a satisfactory solution to the assigned task. A Pearson correlation was run using the media-use classifications and the mean outcome satisfaction score. The results of this analysis (see Table 6) support hypothesis 2 (p=.015, r=-0.237 N=105).

Hypothesis 3

There will be a correlation between the use of diverse communication modes and interaction effectiveness.

This hypothesis tests the premise that using different modes of interaction for the completion of the task will result in group members experience of effective communication. The results (see Table 7) of a Pearson correlation between the three media use levels and the effective communication score reveal no significant correlations.

Hypothesis 4a

Where active decisions about communication modes are made, there will be a higher level of interaction satisfaction.

Social construction theories present the notion that decisions within a group about how to interact will establish a supportive framework for the mode of interaction selected. In theory, groups which decide to interact in a particular way, regardless or modality, should have positive views about their interactions while groups which are either forced to interact in a particular fashion or do not make active decisions about how to interact will not perceive their interactions as favorably. Hypothesis 4a addresses this question by using a Pearson correlation test (see Table 8) to assess the relationship between participants actively making decisions about how to interact and their level of satisfaction with their interaction. The results of the test support the hypothesis ($p<0.01$, $r=.448$, $n=89$).

Hypothesis 4b

Where active decisions about communication modes are made, there will be a higher level of outcome satisfactions.

While part 'a' of this hypothesis tests active decisions in terms of interaction satisfaction, part 'b' tests in terms of outcome satisfaction. The contention is that active decision making regarding how the interaction is conducted will also correlate with participant's satisfaction with the outcome of the task. To test this expectation a Pearson correlation (see Table 9) was run using the active decision making and outcome satisfaction scores as variables. The results of this test indicate support for hypothesis 4b. ($p=0.001$, $r=0.36$, $n= 89$).

Hypothesis 5a

There will be decreased diversity of communication modalities used where interaction mode is based on group preference.

This hypothesis proposes that when mode of interaction is based on a group's preference that individual biases and habits will restrict the diversity of interaction mode. It is expected that the groups identified with high or low levels of face-to-face interaction will have a higher communication preference score than groups reporting a more diverse selection of interaction mode. An ANOVA test (see Table 10) was run using communication preference score and the medium face-to-face interaction group. The selection of the medium face-to-face group for this test provides for a comparison between those that use a balance of face-to-face and mediated interaction and those that show more bias toward one of the two extremes. The results of this analysis showed no significant differences between groups.

Hypothesis 5b

There will be increased diversity of communication modalities used where active decisions about communication modes are made.

The process of actively making decisions how to interact implies that the study participants thought about how to interact based on either the needs of the group or the requirements of the task. Survey question 18 specifically addresses this question: We matched communication environment to the task at hand. The tasks assigned to the participants of this study have no explicit solution. As such there is a high likelihood that interactions will include most or all of the types identified by Hollingshead et al. (Table 1). Based on the supposition, the expectation is that there will be a variety of interaction

modes utilized to complete the task. To test this hypothesis, the mean active media-use decisions score was used in an ANOVA test (see Table 11) with the moderate face-to-face interaction group. Like hypothesis 5a ,the selection of the medium face-to-face group for this test provides for a comparison between those utilizing diverse interaction methods and those utilizing mostly face-to-face or mostly mediated interaction. The results of this test were inconclusive.

Summary of Tests of Hypotheses

Summary results for each of the hypotheses are presented in following table (see Table 12). Hypotheses 1, 2 and 4a/b are supported while findings for this study fail to support hypotheses 3 and 5a/b. Further exploration of the data related to the supported hypotheses follows.

Supplemental Analysis

After performing the initial tests for each of the hypothesis some secondary questions developed. In order to better address the relationship between technology focused and socially focused approaches to the understanding of group interactions, the following secondary analyses were performed. The supplemental analysis can be categorized as communication mode and satisfaction, and approaches to group media-use selection.

Communication Mode and Satisfaction

Hypotheses 1 and 2 ask questions of communication mode and the relationship to satisfaction (with interaction and outcome). Based on the high degree of correlation

between interaction satisfaction and level of face-to-face interaction discussed in hypothesis1, a logical follow-up question is to determine the degree of difference between different media-use levels. An ANOVA test was run to determine if the experience between differing media use groups was statistically significant. Results of this test (see Table 13) indicate that there is a significant difference ($F(2,102)=3.55$, $p=0.03$) in the level of interaction satisfaction between the three media-use groups (low, medium and high levels of media use).

Level of Media Use and Interaction Satisfaction

Based on the very high correlation between interaction satisfaction and media use (see Table 5) and ANOVA results indicating that the difference between groups is significant (see Table 13), a secondary analysis was performed by grouping the participants into three media-use groups based on the reported usage of face-to-face interaction time (low face-to-face, med face-to-face and high face-to-face). A Pearson correlation test was run with each of the media-use levels (see Table 14). Results of this analysis clarify the initial test, by identifying the interactive satisfaction relationship to level of media use. There is a positive correlation between interaction satisfaction and high face-to-face interactions ($p=0.05$, $r=0.19$, $n=105$) and a corresponding negative correlation between interaction satisfaction and low face-to-face users ($p=0.01$, $r=-0.25$, $n=105$). These results add clarification to the initial findings of hypothesis 1 by detailing relationship of satisfaction across the spectrum of interaction using low to high levels of media usage.

Follow-up analysis related to hypothesis 2 was run to determine if there is a significant difference between the moderate media-use group and their counterparts in the

high and low face-to-face interaction groups. The results of an ANOVA test ($F(4,100)=2.48$, $p=0.05$) also show that there is a significant difference between these groups (see Table 15). The results of this test lend further support to the premise of hypothesis 2.

Approaches to Group Media-Use Selection

Hypotheses 4a/b and 5b all relate to active media-use decision making which by definition, relate to selecting technology to solve a problem. The inference here is that the technology will aid in the completion of the task. Of the four relevant hypotheses (4a/b and 5a/b) only hypothesis 5a specifically addresses the preferences of the group members related to their mode of interaction.

To accurately address the relationship between social construction theories and technology focused theories a comparative analysis of the three key variables, outcome satisfaction, interaction effectiveness, and interaction satisfaction (see Table 16) was made. The results of this comparison provide an interesting contrast between the students that based their interaction on group preference versus those that engaged in active media-task fitting. A contrast between group preference and active media-use for each of the three primary variables follows.

Outcome Satisfaction

Outcome satisfaction has a positive correlation with active media-use decisions with respect to media selection. In contrast there is a lack of correlation between outcome satisfaction and making media selection based on the preferences of the groups. ANOVA analysis ($F(6,82)=2.97$, $p=0.01$, see Table 17) shows that the degree of outcome

satisfaction is significantly different between participants sighting a high degree of active decision making with respect to how to interact while working on the task.

Interaction Effectiveness

The measure of interaction effectiveness fails to differentiate between levels of active decision-making or group preference. Each of the tests used to analyze the perceived level of effectiveness fail to yield conclusive results. Due to the differing types of tasks and time frames allowed for the completion of the tasks there is not an objective measure of interaction effectiveness. The one point that can be inferred by the results of the tests is that there is little differentiation between the various subject populations. Based on the mean interaction effectiveness score (x=2.87, sd=0.3, n=89) the groups reported an average level of effectiveness in their interactions.

Interaction Satisfaction

Both of the measures of active media-use and group preference indicate a positive correlation to degree of interaction satisfaction. To try and determine if there is a significant difference between the degree of interaction satisfaction and the two groups in question an ANOVA test was run measuring the variance between the active decision and group preference measures (see Table 18). The results again show a lack of support for group preference but active decision-making shows a significant difference (F(12,76)=3.5, p<0.00).

Active Media-Use Decisions

In order to isolate the potential influence of regular class meetings on group preference or active media-use decision making ANOVA tests were run using the email and phone interactions measured in this study. The results of the tests show a lack of differentiation between the interaction methods and active media-use decisions (see Table 19 and 20). These results infer that where active decisions were made about how to interact outside of the classroom setting a diversity of modes were used. These findings lend support for hypothesis 5b.

ANOVA analysis of group preference and the use of email and the telephone show an association with the use of the telephone. This indicates that for interactions outside of the class room setting that the telephone was a preferred mode of interaction. The results indicate a preference toward using the phone. This secondary analysis lends support for hypothesis 5a, indicating that beyond the biases toward face-to-face interaction that groups interacting based on preference chose to use the telephone as the preferred alternative.

Summary of Results

Secondary data analysis clarifies the relationships between modes of interaction and degree of satisfaction (see Table 21). The question of interaction effectiveness lacks support. Research utilizing different methodologies will be required to verify these findings, the variable nature of the projects and the method of capturing data have made the question of interaction effectiveness difficult to assess.

Table 2: Communication Modalities

	N	Minimum	Maximum	Mean	Std. Deviation
Face-to-face	105	0.00%	100.00%	58.33	32.07
Email	105	0.00%	100.00%	34.95	29.64
Phone	105	0.00%	50.00%	5.29	9.70
Instant Messaging	105	0.00%	20.00%	0.52	2.59
Voice Message	105	0.00%	15.00%	0.91	2.57
Valid N (list-wise)	105				

Table 3: Media Use Distribution

Media Use Level	% of Face-to-Face Interaction
High-Media Use	80% - 100%
Medium-Media Use	41.66% - 79.99%
Low-Media Use	0% - 41.65%

Table 4: Construction of Primary Variables

Variable	• Component Survey Questions
Media Use	• Approximately what percentage of your time was spent communicating face-to-face?
Interaction Satisfaction	• The primary communication environment we employed helped us share our opinions. • The primary communication environment, which we used, helped us to better understand each other. • When we disagreed, the primary communication environment we used made it more difficult to reach an agreement. • The primary communication environment we used interfered with our ability to complete the project. • When we disagreed, our choice of communication environment helped us reach a common understanding. • My project partner(s) showed me that he/she understood what I said.
Outcome Satisfaction	• I am pleased with the results of my project. • I feel personally invested in the outcome of the project that my partner(s) and I created.
Interaction Effectiveness	• Our primary method of communication facilitated completion of the task. • Most of our communication time was task related. • The primary communication environment we used helped us exchange information and ideas quickly. • The communication environments we used helped us communicate effectively. • There were ideas I couldn't express to the other members of my group because of the communication technologies we used. • I had difficulty communicating some ideas to my partner because of the communication methods we used.
Active Media-Use Decisions	• The availability of my partner(s) dictated which communication environments we used. • Our group made active decisions about how to communicate while working on this task. • We matched communication environment to the task at hand.
Group Communication Preference	• Our choice of primary communication method was based on the preferences of the group. • The group did not discuss our choice of communication method. • The communication environments I employed while working on this project were based on personal preference.

Table 5: Hypothesis 1 - Interaction Satisfaction with Low-Media Usage

		Interaction Satisfaction
Low-Media Usage	Pearson Correlation	.260
	Sig. (2-tailed)	.007
	N	105

Table 6: Hypothesis 2 - Outcome Satisfaction with Medium Media-use

		Outcome Satisfaction
Medium Media Use	Pearson Correlation	-.237
	Sig. (2-tailed)	.015
	N	105

Table 7: Hypothesis 3 - Interaction Effectiveness

		Low face-to-face	Medium face-to-face	High face-to-face
Interaction Effectiveness	Pearson Correlation	.064	-.145	.075
	Sig. (2-tailed)	.562	.185	.496
	N	85	85	8

Table 8: Hypothesis 4a - Interaction Satisfaction with Active Media-use Decisions

		Interaction Satisfaction
Active Media-Use	Pearson Correlation	.448
	Sig. (2-tailed)	.000
	N	89

Table 9: Hypothesis 4b - Outcome Satisfaction with Active Media-use Decisions

		Outcome Satisfaction
Active Media-Use	Pearson Correlation	.360
	Sig. (2-tailed)	.001
	N	89

Table 10: Hypothesis 5a - Medium Face-to-Face by Group Preference (ANOVA)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.117	8	.140	.642	.740
Within Groups	16.530	76	.218		
Total	17.647	84			

Table 11: Hypothesis 5b - Medium Face-to-Face by Active Media-Use (ANOVA)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.528	6	.255	1.232	.299
Within Groups	16.119	78	.207		
Total	17.647	84			

Table 12: Summary of Hypothesis and Findings

Hypotheses	Conclusion
H1: There will be a positive correlation between the use of rich communication modes and the level of interaction satisfaction.	Supported
H2: There will be a correlation between the use of diverse communication modes and the level of outcome satisfaction.	Supported
H3: There will be a correlation between the use of diverse communication modes and interaction effectiveness.	Lacks Support
H4a: Where active decisions about communication modes are made, there will be a higher level of interaction satisfaction.	Supported
H4b: Where active decisions about communication modes are made, there will be a higher level of outcome satisfactions.	Supported
H5a: There will be decreased diversity of communication modalities used where interaction mode is based on group preference.	Lacks Support
H5b: There will be increased diversity of communication modalities used where active decisions about communication modes are made.	Lacks Support

Table 13: Interaction satisfaction by Level of Media Use (ANOVA)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.112	2	.556	3.547	.032
Within Groups	15.987	102	.157		
Total	17.099	104			

Table 14: Interaction satisfaction by Media Use Level

		Low face-to-face	Medium face-to-face	High face-to-face
Interaction Satisfaction	Pearson Correlation	-.248	.056	.188
	Sig. (2-tailed)	.011	.571	.054
	N	105	105	105

Table 15: Medium Face-to-Face by Outcome Satisfaction (ANOVA)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.930	4	.483	2.475	.049
Within Groups	19.498	100	.195		
Total	21.429	104			

Table 16: Correlation of Group Media-Use Selection and Satisfaction

		Outcome Satisfaction	Interaction Effectiveness	Interaction Satisfaction
Active Media-Use	Pearson Correlation	.360	.158	.448
	Sig. (2-tailed)	.001	.139	.000
	N	89	89	89
Group Preference	Pearson Correlation	.047	.168	.246
	Sig. (2-tailed)	.660	.116	.020
	N	89	89	89

Table 17: Outcome Satisfaction by Active Media-Use Decision (ANOVA)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.596	6	.766	2.971	.011
Within Groups	21.140	82	.258		
Total	25.736	88			

Table 18: Interactive Satisfaction by Active Media-Use and Group Preference (ANOVA)

		Sum of Squares	df	Mean Square	F	Sig.
Active Media-Use Decision	Between Groups	6.185	12	.515	3.505	.000
	Within Groups	11.175	76	.147		
	Total	17.361	88			
Group Preference	Between Groups	4.022	12	.335	1.080	.388
	Within Groups	23.576	76	.310		
	Total	27.598	88			

Table 19: Communication Modalities by Active Media-Use (ANOVA)

		Sum of Squares	df	Mean Square	F	Sig.
Email	Between Groups	2593.700	6	432.283	.488	.815
	Within Groups	69101.594	78	885.918		
	Total	71695.294	84			
Phone	Between Groups	794.693	6	132.449	1.401	.225
	Within Groups	7375.895	78	94.563		
	Total	8170.588	84			
Face-to-Face	Between Groups	4143.039	6	690.507	.675	.670
	Within Groups	79832.255	78	1023.490		
	Total	83975.294	84			

Table 20: Communication Modalities by Group Preference (ANOVA)

		Sum of Squares	df	Mean Square	F	Sig.
Email Usage	Between Groups	6742.283	8	842.785	.986	.454
	Within Groups	64953.011	76	854.645		
	Total	71695.294	84			
Phone Usage	Between Groups	2342.757	8	292.845	3.819	.001
	Within Groups	5827.832	76	76.682		
	Total	8170.588	84			

Table 21: Summary of Secondary Analysis and Findings

Variable	**Results**
Communication Mode and Satisfaction	There is a significant difference in the level of interaction satisfaction between the three media-use groups.
Level of Media Use and Interaction Satisfaction	Positive correlation between interaction satisfaction and higher usage of face-to-face interaction. Negative correlation between interaction satisfaction and lower usage of face-to-face interaction.
Approaches to Group Media-Use Selection	
Outcome satisfaction	Outcome Satisfaction has a positive correlation with Active Media-Use Decisions with respect to media selection. Interaction method based on Group Preference lacks correlation with Outcome Satisfaction.
Interaction Effectiveness	No relationship could be found between Interaction Effectiveness and Group Preference or Media-Use Decisions.
Interaction Satisfaction	There is a significant difference in interaction satisfaction between degree of Active Media-Use
Active Media-Use Decisions as a Predictor	Active Media-Use Decisions are a significant predictor of satisfaction.

CONCLUSIONS

The purpose for this study is three fold. First, to test computer mediated communication theories in a natural setting, with the goal of exploring the influences of technology on interaction. Second, to assess whether social or technology influences express the strongest influence on factors like satisfaction and effectiveness. Third, to explore ways of reconciling the competing nature of theories representing technologically deterministic approaches versus socially constructed approaches to better inform understanding of group interaction. My hope is that results from this study may be applied to improving the interactive experience of students in classroom settings where group tasks are a routine part of the learning experience. Results from this study may also provide insights into how to organize class activities to produce positive interactive experiences.

Interaction and Communication Modalities

The specific aspect of interaction addressed by this study is satisfaction. Satisfaction is considered both in the quality of the interaction between the members of a project group and satisfaction with outcome of the interaction. Tasks assigned to the participants in this study are of the type that fit well as tests for the premise of media

richness theory, (Daft & Lengle, 1984) which argues that rich modes of communication are best suited to interactions with high levels of ambiguity. The open-nature of these projects create the potential for experiencing all four, task types (see Table 1) identified in time interaction and performance theory (Hollingshead, McGrath & O'Connor, 1993). The flexible environment provided by the class instructors of the classes allowed students the opportunity to choose how to interact.

The findings from this study indicate that the students who chose to use a majority of face-to-face communication time during the completion of their course assignments felt a greater level of interaction satisfaction. In contrast those that chose to use lean modes of interaction experienced lower levels of satisfaction. These findings support Baltes' contention that "that CMC group members are rarely if ever more satisfied than members of face-to-face groups" (Baltes et al., pg.175, 2002).

While comparisons between groups categorized as have a low face-to-face interaction level and high face-to-face interaction levels show a distinct difference in the reported levels of satisfaction, the use of email is also an indicator of interaction satisfaction. Extensive use of email for the completion of project tasks also resulted in a lower level of interaction satisfaction. The negative relationship between email use and interaction satisfaction provides an interesting challenge to Walther's (1996) position that interactions utilizing lean modes of interaction will be as satisfactory as traditional interpersonal interactions. He does argue, however, that there is an increased time requirement to allow interactions experienced using lean forms of communication to be considered as satisfying as face-to-face interactions. This raises the question, what amount of time is required to develop a comparable level of satisfaction over time? If the required amount of time is extensive how does this impact ad hoc groups that may not

benefit from extensive interactions? Based on the levels of interaction satisfaction reported by participants in this study, the implication is that extensive use of mediating technology for short-term tasks may be a significant factor in diminished satisfaction. Factors related to Social Influence Theory (McGrath, 1991) like time spent interacting and the duration of the group organization become important factors for predicting level of satisfaction.

This study also shows that students using a diversity of interaction methods have a higher degree of satisfaction with the outcome of their projects. These findings show that factors related to outcome satisfaction may benefit from different approaches to interaction and that these changes may have a negative influence on interaction satisfaction. This particular assessment based on technology selection indicates that concepts presented in time interaction and performance theory (Hollingshead & McGrath, 1993; McGrath, 1991) and media synchronicity theory (Dennis & Valacich,1999) may provide strategies for finding satisfactory resolution to the types of tasks experienced by the participants of this study. Specifically, groups which actively selected communication modes based on the needs of the task showed a positive correlation with both interaction satisfaction and outcome satisfaction. These results indicate that matching media type, message, and task type yield both positive outcome satisfaction and positive interaction satisfaction.

The groups that chose interaction mode based on preference (rather than task fit) did not have this experience. When method of interaction was predominantly based on preference, participants in the study reported being satisfied with the nature of their group interactions. This finding is expected, as it is not reasonable to believe that an individual would intentionally choose to interact in a way that is not satisfying unless there is some

other external factor motivating that choice. The motivating factors may present in the form of convenience or constraining influences.

Participants in this study had regular opportunity to interact face-to-face because the class they were participating in had a regular schedule for in-person meetings. For some groups the convenience of meeting before or after the officially scheduled meeting may have motivated greater face-to-face interaction. Conversely, participants with schedules that would not allow for the convenient before or after class meeting opportunities might be motivated to use other communication modalities. Both circumstances illustrate factors that can motivate interactive behavior. The distinction that is important to recognize is that a group can respond to a situation actively or passively. The results of this study indicate that interaction based on preference or convenience is not an indicator of outcome satisfaction while active selection of interaction mode with respect to task fit appears to be one of the important factors for finding satisfaction in the outcome of a task.

Social influence within group work (Fulk, 1993) may provide some explanation. Fulk presents the dilemma of either preexisting attitudes or attitudes about communication mode developed during the completion of the task as factors that can shape a participant's perceptions of effectiveness. That is, factors unique to each project group may create or reinforce opinions about how effective different communication modes might be. Thorngate's "Economy of Attention" and the paradox described by Robert and Dennis (2005) may influence interaction preference and subsequent assessments of effectiveness. According to McGrath (1991) social influence factors may be useful for understanding the contributing factors related to effective communication. Social factors like group understanding of communication modes and preexisting

interaction behaviors may be factors that made definitive analysis of interaction effectiveness somewhat impractical in the current study. Further refinements based upon this study may provide a framework for identifying a clearer relationship between interaction effectiveness and the presented theories.

Interaction effectiveness also proved to be a difficult variable to resolve with respect to technology influences. The nature of this study and the subjective method of assessing effectiveness leave this hypothesis open for further investigation. However, if time interaction and performance theory (TIP; Hollingshead & McGrath, 1993; McGrath, 1991) or media synchronicity theory (MST; Dennis & Valacich,1999) can be used as a tool for predicting effectiveness, some more identifiable relationship between effectiveness and diversity of communication mode or active decision making will need to be developed.

The lack of correlation between those theories (TIP, MST) and the experiences reported by the study participants present many questions. One possible answer may be to use more precise ways to assess interaction effectiveness. Some of the studies cited in this thesis used highly controlled settings with time constraints and limitations on interaction mode to assess effectiveness. For those studies to be useful, similar results will need to be found in real world interactions. Another possibility is that there simply is a need for better theories in understanding interaction effectiveness. It seems clear that the role of social influences will be required of such perspectives.

Group Preference and Active Media-Use

Variables used in this study reveal relationships between interaction satisfaction and interaction effectiveness. This relationship points toward social influence factors

playing an identifiable role in constructing how a group interacts. Where groups do not have the opportunity to interact face-to-face as a regular form of interaction, the use of mediating technologies like the telephone or email are the expected modes of interaction[3]. The data gathered here reflect this, with email and the phone being the second and third most frequently used modes of interaction, respectively. This may be based on preference associated with familiarity or access to a limited subset of communication-mediated options. The result is an understanding that groups can experience high interaction satisfaction but when the technological limitations associated with not utilizing an optimal media-task fit, that can lead to groups that also experience decreased effectiveness and decreased outcome satisfaction.

Of the mediated modes of interaction, the phone is the mode that is considered richest according to media richness theory (Daft & Lengle, 1984). It has immediacy and the ability to convey meaning that is often lost when using text based modes of communication. Aside from richness values, the phone is also arguably the most pervasive method of mediated interaction available. If group preference decisions are based on access and familiarity, then a relationship with the use of the phone would be expected. The data shows a strong negative correlation between the use of the phone and degree of group preference (p=0.05, r=-0.21, n=89). This can be interpreted in a couple of different ways. First, it may simply be that the use of email is a preferred mode of interaction over using the phone when opportunities to meet face-to-face are not available. However, it may also be that assessment of active media-use is difficult to separate from preference. Put another way, it is not clear whether the participants chose email over

[3]One of the study groups was unable to meet in person to work on their project because a group member was required to travel with the University basketball team. 100 percent of their project interaction time took place via email.

face-to-face or the phone because of the convenience that asynchronous interaction provides, or that there are other task-related benefits associated with this mode of interaction.

The data shows that group preference does not correlate with positive outcome satisfaction, while active media-use does correlate with both interaction and outcome satisfaction. If the individual chose to interact in a particular way based on preference while understanding the attributes of other modalities, that would be a kind of active media-use decision in which preference was the deciding factor and media-task fit results were not. This makes a clear differentiation between preference and active media selection difficult at best.

The data does indicate, however, a clear bias toward face-to-face communication. This may be closely related to the fact the participants had frequent classroom opportunities to meet face-to-face and that those opportunities were part of the decision making process. The opportunity to interact provided by the class sessions may have played a part in active decision-making. Alternatively, the regular meeting times may have provided a convenient point for interaction that could be interpreted as a group preference factor. In practice, the opportunity to interact on a regular basis provided by the class meetings can be understood as being related to both active decision-making and group preference.

Limitations

Because there is a distinction between active media-use satisfaction and that related to group preference, it is reasonable to expect that good project management and technology literacy are contributing factors. The survey tool used for this study did not

ask about specific access to all of the technologies or questions of comfort and proficiency with those technologies. The presumption is that all of the participants in the study have access to and are comfortable with all of the measured modes of interaction. More information about the degree of proficiency with each of the measured modes of interaction may have revealed valuable information. In addition to this ambiguity the method of data collection introduced was unable to control for other factors.

The participants of this study were asked to respond to the media usage survey at the point of completion of the assigned task or at the completion of a major section of a larger project. The participants were not asked to keep any interaction logs during the course of their work on the project. This results in data based on the recollections of the participants and not on any form of rigorous record keeping. The expectation is that larger patterns of interaction and levels of satisfaction were recorded. These patterns represent general and perhaps summary trends and behaviors and not patterns of a series of specific moments of interaction. A detailed exploration of the interactions might reveal other details about the relationship between communication technologies and group interactions. In addition to the nature of the data collection, some of the data sets were not complete due to technical errors in the data collection. This resulted in only 89 usable records related to active media-use and group preference in contrast to the 105 total records gathered.

The five communication modalities selected for use in this study are presumed to be mainstream modes of interaction for a typical college undergraduate. The Pew Internet and American Life Project (Lenhart, Madden, Macgill, Smith, 2007) reports in a study of media use that the top four methods of interaction by those surveyed are telephone (cell and land line), face-to-face, text messaging and email. For individuals

with cell phones texting becomes more common than interacting face-to-face. Based on this preliminary finding, measuring the usage of these specific modes of interaction would seem appropriate.

Suggestions For Future Research

Group preference and active media-use decisions provide an interesting dynamic for study. This study indicates that there is a relationship between interaction satisfaction and group preference. A potential component of this relationship is the skill level of the participant. Media choices and preferences reflect the individual's beliefs and skills related to the use of a particular mode of interaction (Treviño, Webster & Stein, 2000). What is the relationship between an individual's expertise with a given mode of interaction and preference? How does this expertise correlate with whether that mode of communication is selected for a group interaction? Gathering more data related to why individuals choose to interact in a particular fashion and their level of communication technology literacy may give more insight into the relationship between communication technologies and the construction of interaction behaviors.

The results for hypotheses 1 and 2 indicate support for theories like media richness, media synchronicity, and time interaction and performance. At the same time, the results for hypotheses 4a and 4b support the crucial role of social influence factors (Fulk, 1993). Technology-focused theories generally argue specific capabilities for the different modes of interaction. A notable example is time interaction and performance theory (McGrath, 1991) in which the technology is imbued with the capacity to enable particular types of interaction. The social construction perspective argues that the experience of the group members and the purposes for the interaction of the group will

dictate how the group will interact. Walther (1995) argues that given enough time to develop the interactive capacity of the group members, the mode of interaction itself will have less influence on the communication capabilities of the participants.

Consideration of the different perspectives is demonstrated in the study data. It appears that (1) both perspectives have validity, and (2) they are not mutually exclusive. If both models are to coexist within the dynamics of a group engaged in the completion of a task, a documentable interaction between theses theories needs to be developed. One possible way to bring these perspectives together is to recognize that the technologies have inherent capabilities that are independent of the participants in a group. As a group forms, the participants bring attitudes and abilities toward different modes of interaction within the group. Over time the level of experience both with group members and methods of interaction are likely to develop. The development of these aspects for a given group will change the relationship between the group and the inherent characteristics of communication technologies for that group.

These principles should apply to any mode of interaction, whether this is the inefficiencies of meeting face-to-face or the diminished feedback or misunderstanding that may result from an email exchange. The method of interacting is not neutral in how it conveys information. These benefits and liabilities are well researched and documented (although possibly still open to further debate). As a group functions over time they will develop strategies for working together which overcome the limitations of the technology (Treviño, Webster & Stein, 2000; Walther, 1995; Walther, & Bunz, 2005) or the participants will develop the ability to manage and leverage the capabilities of the various communication modalities. In either case, the thing that changes is the capabilities of the

group. Gaining education and experience with respect to how a group interacts and the best methods for completing tasks takes place over time (see Figure 1).

Crossing the barrier from being subject to the technologies to leveraging them represents gaining literacy with interaction modalities and establishing group identity and behavioral norms. Crossing the technology influence line does not equate to mastery of a given mode of interaction or the ability to apply media-task fit to each exchange, but represents a change in the relationship with the technology where effectiveness and satisfaction may be experienced. Additional time and experience with both the dynamics of the group and use of communication technologies should result in improved interaction effectiveness.

Over time, development of the group may have greater influence on factors like effectiveness and satisfaction than the utilized modes of interaction themselves. In this respect the communication modes (Table: 1) are static and group preferences and the ability to make active decisions about how to interact can and likely do change over time. Research to identify the level of familiarity with communication technologies and the length of time a group needs to function in order to cross over this "tipping point" from having interaction mode be a predictive factor to experiencing group characteristics as the predictive factor will be valuable. Further exploration of these particular issues may yield better models for understanding the interplay between social and technological factors within group conduct and performance. Further research in this area may also allow educators and project managers the ability to expedite the transition from below the technology line to above it.

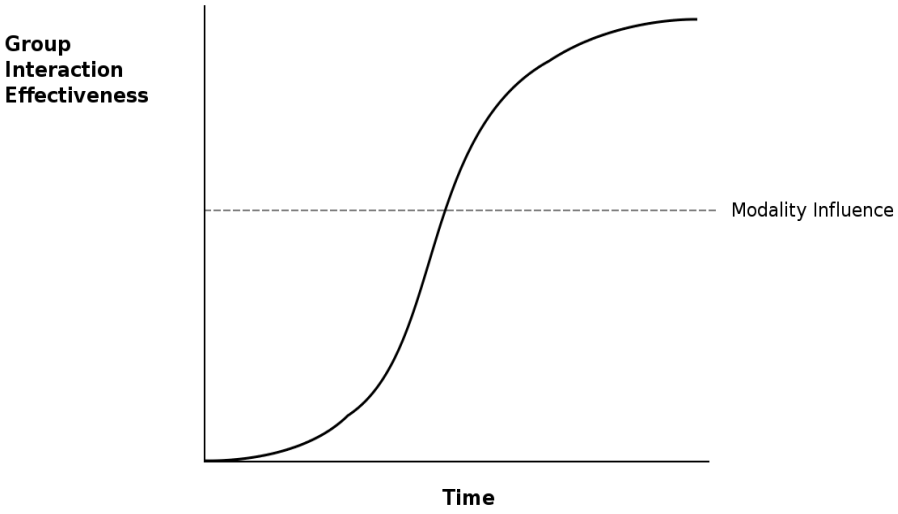

Figure 1: Group Performance and Interaction Ability Over Time

APPENDIX

SURVEY

Notes About the Survey

The following survey will be presented via the web. The type of response interface is identified following the question. Text boxes allow the participant to enter a response, Likert scales are presented using drop down menus with the appropriate response scale for the question. Combo boxes use the same drop down menu interface containing responses appropriate to the question.

All data is submitted to a relational database with restricted access.

Interaction and Media Use Survey

1. What is your student ID?

2. Describe the subject of your project.

When you communicating about how you would accomplish the task, tell us about your interactions.

3. Approximately how much total communication time in minutes did you spend in completing this project?

4. Approximately what percentage of your time was spent communicating face-to-face?

5. Approximately what percentage of your time was spent communicating via email or text messaging?

6. Approximately what percentage of your time was spent communicating via the phone?

7. Approximately what percentage of your time was spent communicating via instant messaging?

8. Approximately what percentage of your time was spent communicating via voice message?

About Your Communication Mode Choices

9. Our choice of primary communication method was based on the preferences of the group.

10. Our primary method of communication facilitated completion of the task.

11. Our choice of communication method was not discussed by the group.

12. The availability of my partner(s) dictated which communication environments we used.

13. Our group made active decisions about how to communicate while working on this task.

Tell us about your experience while working on this class project.

14. I am pleased with the results of my project?

15. The primary communication environment we employed helped us share our opinions.

16. Most of our communication time was task related.

17. The primary communication environment we used helped us exchange information and ideas quickly.

18. We matched communication environment to the task at hand.

19. The communication environments I employed while working on this project were based on personal preference.

20. The primary communication environment that we used helped us to better understand each other.

21. When we disagreed, the primary communication environment we used made it more difficult to reach an agreement.

22. The communication environments we used helped us communicate effectively.

23. The primary communication environment we used interfered with our ability to complete the project.

Give us your perceptions on working with your project partner(s).

24. I feel personally invested in the outcome of the project that my partner(s) and I created.

25. There were ideas I couldn't express to the other members of my group because of the communication technologies we used.

26. I had difficulty communicating some ideas to my partner because of the communication methods we used.

27. Most of our communication time was socially oriented.

28. When we disagreed, our choice of communication environment helped us reach a common understanding.

29. My project partner(s) showed me that he/she understood what I said.

30. How do you feel about the collaboration you shared with your project partners?

About You

31. What is your age in years?

32. What is your gender?

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